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## People's Perceptions about the Socio-Economic and Environmental Impact of Coastal Green Belt in Bangladesh

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### ABSTRACT

Understanding the perceptions and attitudes of local people towards afforestation is crucial for successful afforestation. To better understand the people's perceptions about the coastal green belt, we surveyed the Satkhira and Bhola districts during January 2021. A questionnaire survey of 200 respondents was conducted by a purposive and random sampling technique to obtain quantitative data. On the other hand, two Focus Group Discussions (FGDs) were performed to obtain qualitative data based on the diversity of age, sex, education, and occupation variables. We used to evaluate the respondent's perceptions about the coastal green belt by 5-point Likert scale data. The majority portion of the people in our study area was poor and their profession was fisherman and housewife among males and women respectively. The majority of them agreed that the green belt helped them in numerous ways, to rear their cattle and built a house near the green belt, by promoting the growth of crops, and further protect them from different natural calamities by reducing wind velocity. Shelterbelts greatly enhance tourism in that area, improved communication facilities, and increase their socio-economic condition and values. Shelterbelt has long-term benefits, peoples have positive attitudes towards shelterbelt and they seek training to maintain this shelterbelt smoothly. Respondents wanted fruit tree species as shelterbelt species near the embankment. This information can be used for policy formulation in terms of successful plantation by considering people's attitudes, which may work in both mitigation and adaptation of climate change in the coastal remote areas of Bangladesh.

### INTRODUCTION

Bangladesh's coastal zone stretches along the Bay of Bengal, covering 47,201 Km<sup>2</sup> (32 percent of the country, including 19 districts) and lies between 21<sup>0</sup>-23<sup>0</sup> North latitude and 89<sup>0</sup>-93<sup>0</sup> East longitude (Islam, 2004; Ahmed, 2019). Bangladesh's coastal zone is divided into three sections based on geographic features: the eastern zone, the central zone, and the western zone. The semi-active delta is crisscrossed by several channels and creeks in the western section. The most dynamic and continuous processes of accretion and erosion occur in the middle region, whereas the eastern section is covered by a mountainous terrain that is more stable (Thomas, 1992). This region has a population of

36.8 million people, with more than half of them (52%) living in poverty (based on living standard) (Islam, 2008).

In coastal areas, road infrastructure, power, housing, transportation, sanitation, and coastal protection are all lacking. Woodcraft, artesian employing wood, bamboo, CI sheet (tin), and other locally accessible materials are used by the local coastal people to construct their homes. The poorest populations in the coastal areas are the most exposed to and victims of climate change's negative effects (Islam & Rahman, 2015). A green belt is an area set aside for open space, usually in the vicinity of larger cities (Ramesh, 2014). The "green belt" as a concept is an important part of sustainable

development in the twenty-first century (McMichael AJ, 2000). A greenbelt is needed for protecting the embankment from tidal surges through plantings on its outer slope, and for protecting life and property in the region by embankment plantings (Ramesh, 2014).

Climate change which is a result of global warming is an extremely crucial issue in Bangladesh that severely affecting the natural environment (Hossain et al., 2010). Bangladesh is one of the most vulnerable countries in the world to the early effects of climate change because it is a low-lying country (MoEF, 2008). Climate change is responsible for damaging the property of Bangladesh's people, particularly those living along the coast and on the char islands (Islam & Rahman, 2015). As a result, this enormous coastal area requires management, coastal ecosystem protection, and coastal community safety (Ahmed, 2019).

Forests that act as sinks can significantly reduce greenhouse gas concentrations in the atmosphere, helping to mitigate climate change (IPCC, 2007). Shelterbelts generated by trees along the world's coasts are widely acknowledged for minimizing the negative effects of climate change (Latief & Hadi, 2007; Tanaka *et al.*, 2007), desertification management (Mohammed et al., 1996), stabilize soil to reduce sand shifting (Mohammed *et al.*, 1996; Bai, 2010), lowering wind speeds and minimizing tsunami damage (Torrey, 1976; De Zoysa, 2008), protecting cyclones and typhoons (Bai, 2010) and others. Bangladesh's coastal management and development programs began in the early 1960s with the construction of coastal embankments, the creation of coastal greenbelts, community-based management, and delta development (Iftekhar, 2006).

Coastal embankments were erected along the coastal region from 1960 to 1980 to conserve agricultural lands and increase rice output. Against nature's will, a total of 5017 km of embankments were built throughout the coastline region (Rahman & Rahman, 2015). Because local people are the primary stakeholders in the Coastal Green Belt (CGB), it's crucial to understand their perspectives on the CGB in Bangladesh's coastal region. The purpose of this study is to find out the perceptions of local peoples towards the Coastal Green Belt and to know the way through which people get benefit from the coastal green belt. This understanding of

people's perceptions is critical for the authority to make better administrative decisions for the long-term growth of CGB in Bangladesh's coastal region.

## **MATERIALS AND METHODS**

### **Study area**

This research was conducted in the coastal districts of Satkhira and Bhola. Munsiganj union in Satkhira District's Shyamnagar Upazila and Char Kukri-Mukri union in Bhola District's Charfashion Upazila were chosen for research. Because of the presence of a green belt near the riverfront on the embankment, these two unions were chosen. Shyamnagar Upazila is located between 21°36' to 22°54' North Latitude and 88°54' to 89°20' East Longitudes under Satkhira district (BBS, 2011) while Charfashion Upazila is located between 21°54' to 22°52' North Latitude and 90°34' to 91°01' East Longitudes under Bhola district (BBS, 2011).

### **Sampling method**

Before collecting data, we did a reconnaissance survey in the research area to acquire a sense of the area. We addressed the study objectives with local residents during the survey, which helped to understand the current state of the study area. To achieve the study's goals, we created a questionnaire for the chosen community. We utilized a 5-point rating Likert scale for the questionnaire since Likert scales are popular in survey research because they make it easy to operationalize personality traits or judgments. Miah et al. (2013) used Likert scale values in their survey for finding the impact of *casuarina* shelterbelt in the Chittagong coast of Bangladesh.

For analysis, we used the following scale: strongly agree = 5 points, agree = 4 points, neutral = 3 points, disagree = 2 points, and strongly disagree = 1 point. In this study, four villages (i.e., Munsiganj, Harinagar, Parshokhali, Chunkuri) of Shyamnagar Upazila under Satkhira district and four villages (i.e., Babuganj, Rasulpur, Hajipur, Nabinagar) of Charfashion Upazila under Bhola district were selected objectively. A total of 200 respondents (i.e., 100 in Munshiganj union and 100 in Char Kukri-Mukri union) were selected by a purposive and random sampling technique based on objectives for conducting the interview and to ensure a representative proportion of different professions, shelterbelt beneficiaries, and local

stakeholders. Therefore, a total of 200 populations constituted the sample of the study. Two Focus group discussions were conducted to assess the overall impact of the shelterbelt and to determine if any significant changes in the perceptions between the individual households and the focus group.

#### Data collection and Analysis

We used two types of methodologies to achieve the study's goals: qualitative or descriptive analysis and quantitative analysis. In January of 2021, a questionnaire survey of 200 respondents and two Focus Group Discussions (FGDs) were performed to obtain quantitative and qualitative data, respectively. A five-point questionnaire interview with a single person in the quantitative and a focus group discussion (FGD) with 10-15 individuals (mostly from the area around the embankment plantation) in qualitative parts, were used. Secondary data was gathered from a variety of journals, publications, research papers, websites, and other official and non-government documents, both published and unpublished. After completing the data collection from personal interviews, we transferred schedules to a master sheet for facilitating tabulation. The report of the study is

written and analysis is done systematically by using a computer program of MS word, Microsoft Excel, and SPSS of version 20.

#### RESULTS AND DISCUSSION

The demographic profile of the respondents surveyed in the study area is shown in Table 01. Young and very young persons dominated the research area's respondents, with an average education level of class six and a monthly income of 9785.00 BDT, respectively. Education, an important socio-economic element and a key to individual and communal empowerment, make a farmer more accessible to extension organizations for advice and more capable of dealing with technical recommendations that demand a certain degree of literacy (Tripp, 1993). In both research areas, women's participation in household income was very low. Nurunnahar *et al.* (2020) also found in Satkhira District's Shyamnagar Upazilla, women's participation in household incomes was very low. Discrete gender discrepancy is found in a contribution where different earning activities are higher at the local level (Angelsen *et al.*, 2011).

Table 1. The demographic profile of the respondents in the study area

Selected characteristics of the respondents	Categories	Number and percentage (%) of the respondents
Gender	Male	140 (70%)
	Female	60 (30%)
	Total	200
Age (years)	Very young (18-25)	52 (26%)
	Young (26-35)	72 (36%)
	Middle aged (36-45)	44 (22%)
	Old (above 45)	32 (16%)
	Total (Mean = 31)	200
Level of education	Illiterate	35 (17.5%)
	Class I-V	89 (44%)
	Class VI-X(SSC)	54 (27%)
	Above SSC	22 (11%)
	Total (Mean = class VI)	200
Monthly income in BDT	< TK.3000	47 (23.5%)
	Tk. 3000- Tk.5000	13 (6.5%)
	Tk.5001-Tk.10000	33 (16.5%)
	Tk. 10001-Tk.15000	79 (39.5%)
	Above Tk.15000	28 (14%)
	Total (Mean =9785)	200
	Fisherman	76 (38%)

Profession	Housewife	51 (25.5%)
	Day labor	8 (4%)
	Student	16 (8%)
	Boatman	8 (4%)
	Farmer	14 (7%)
	Businessman	11 (5.5%)
	Gher	6 (3%)
	Cowboy	3 (1.5%)
	Baoali	7 (3.5%)
	<b>Total</b>	<b>200</b>

Furthermore, the most common occupations in the research area were fishermen for men and housewives for women. Dey *et al.* (2020 a) also found a maximum number of respondent's professions were fisherman and housewife among male and female respectively in the Munshiganj union under Shymnagar Upazila of Satkhira district. Islam *et al.* (2020) found middle-aged dominated respondents and most of their Education was up to the primary level in the different unions of Dacope Upazila under Khulna district. Islam *et al.* (2011)

observed at East Dhangmari in Dacope Upazila of Khulna district, the average literacy rate was class five, and the income of the respondents was 4620 BDT. Saha *et al.* (2015) found in the same study area, the average yearly income for a boatman and an eco-tour guide was Tk. 8495 and Tk. 4433, respectively. Dey *et al.* (2020 b) observed respondents' mean monthly income was 6775 BDT. and mean education level was class six in the Dacope and Shymnagar Upazila under Khulna and Satkhira district respectively.

Table 2. Descriptive statistics of variables

Strongly agree = 5, agree = 4, neutral = 3, disagree = 2 and strongly disagree = 1

List of variables (used Likert scale data)	Munsiganj Union (Satkhira)			Char Kukri-Mukri union (Bhola)		
	Mean	Standard Deviation	CV(%)	Mean	Standard Deviation	CV (%)
Is there present any active shelterbelt in this area?	3.714	0.912	24.577	3.979	0.432	10.868
Is this shelterbelt helps to build the house near the shelterbelt?	4.204	0.539	12.827	4.081	0.533	13.076
Is this shelterbelt helps rare cattle near the shelterbelt?	4.142	1.080	26.071	4.040	0.911	22.568
Is this shelterbelt promotes the growth of crops?	4.020	1.108	27.571	4.081	0.885	21.705
Is there reduce wind velocity from previous for this shelterbelt?	4.428	0.841	19.004	4.510	0.581	12.898
Is this shelterbelt protecting people from storms?	4.857	0.353	7.279	4.918	0.276	5.624
Is this shelterbelt protecting people from flood and tidal surges?	4.918	0.276	5.624	4.959	0.199	4.031
Is this shelterbelt protecting your village?	4.877	0.331	6.790	4.918	0.276	5.624
Is this shelterbelt having aesthetic value?	3.836	0.986	25.706	4.040	0.762	18.873
Is this shelterbelt promoting tourism in this area?	4.122	0.807	25.210	3.755	0.778	20.721

Is this shelterbelt improving communication facilities?	4.163	0.986	23.690	4.285	0.889	20.760
Is this shelterbelt promoting the growth of mainland species?	3.987	1.159	29.736	3.612	1.057	29.262
Is this shelterbelt improving people's economic condition?	4.469	1.022	22.882	4.510	0.868	19.266
Are there having long-term benefits to this shelterbelt?	3.836	1.047	27.308	3.591	0.733	20.425
Do you get any benefit from this shelterbelt?	3.551	1.191	33.584	3.285	0.763	23.244
Do you get any training for protecting shelterbelts?	2.897	0.962	33.221	2.938	0.875	29.801
Is there any awareness among people to protect this shelterbelt?	3.591	1.097	30.560	3.122	0.927	29.694
People's attitude is positive towards shelterbelt?	4.448	0.843	18.951	4.306	0.619	14.381
Are there any obstacles to protect this shelterbelt?	3.653	0.925	25.331	3.918	0.702	17.922
Are you satisfied with the present species in this shelterbelt?	3.448	1.173	34.030	3.244	0.902	27.800

The majority of respondents in both research regions (Char Kukri-Mukri and Munshiganj) believed that shelterbelts aid in the construction of houses near shelterbelts, help to rear cattle and the promotion of agricultural crop growth (Table 2). They also agreed that the shelterbelt reduces wind velocity, which protects people from natural disasters such as storms, floods, and tidal surges by shielding their community. Furthermore, they agreed that the shelterbelt offers aesthetic values, such as assisting in the development of tourism and communication facilities. Furthermore, they stated that they had favorable opinions toward shelterbelts and believe these shelterbelts improve their socioeconomic status. Many people disagree that people are aware of the need to protect the shelterbelt and that people want a more stable shelterbelt than the one now in place (Table 2).

Miah et al. (2013) found that a shelterbelt built of *Casuarina equisetifolia* reduces wind speed greatly and promotes native species growth at the Park beach area on Bangladesh's Chittagong coast. A shelterbelt, according to the Food and Agriculture Organization (FAO, 1989), can lower wind speed to a minimum from its highest level. De Zoysa (2008) in Sri Lanka; Hipsey et al. (2004) in Australia, Hanjie, and Hao (2003) in China shelterbelts can also lower wind speed to a minimum from its

highest level. Fritz and Blount (2007) confirmed that wind speed and storm waves can be reduced by coastal vegetation including mangroves. Brandleet al. (2000) stated that coastal vegetation's effective windbreak capabilities are determined by height, density, direction, length, width, continuity or uniformity, and cross-sectional shape. Hipsey et al. (2004) stated that shelterbelts along agricultural land can protect agricultural land from sea-salt spray and enhance crop output. Hossain et al. (2008) found that the coastal green belt project increases the income of participants and improves their socio-economic condition at three Upazila of Noakhali district.

Miah et al. (2013) also found shelterbelt made with *Casuarina equisetifolia* increase growth of crops, facilitates tourism and protecting cyclonic storms at the Parki beach area on the Chittagong coast of Bangladesh. Moreover, Hossain et al. (2008) found that the coastal green belt project changes occupational attributes, assets, occupation, sources of drinking water, and environmental parameter positively at three Upazila of Noakhali district.

Table 3. Species choice by local people for embankment plantation

Common Name	Scientific Name	Percentage (%)
Narikel	<i>Cocos nucifera</i>	26
Aam	<i>Mangifera indica</i>	11
Kanthal	<i>Artocarpus heterophyllus</i>	3
Tal	<i>Borassus flabellifer</i>	8
Amra	<i>Spondias pinnata</i>	7
Kalojam	<i>Syzygium cumini</i>	8
Letchu	<i>Litchi chinensis</i>	5
Peyara	<i>Psidium guajava</i>	3
Khejur	<i>Phoenix sylvestris</i>	2
Akasmoni	<i>Acacia auriculiformis</i>	9
Raintree	<i>Albizia saman</i>	10
Mahogany	<i>Swietenia macrophylla</i>	6
Others		2

Most of the respondents in both study area wants fruits trees as shelterbelt species as fruit trees have immediate feedback after planting (Table 3). But, several respondents want woody species as their timber will be valuable after some time. Wolanski (2007) mentioned that when developing a shelterbelt plantation, the aesthetic values of the vegetation should be examined and prioritized. Miah *et al.* (2013) stated that throughout the establishment of the shelterbelt, social involvement and participatory planning should be followed to gain appropriate protection from the shelterbelt vegetation.

Table 4. Trusted organization by local people for embankment plantation

Organization/ Department name	Percentage (%) at Char Kukri-Mukri (Bhola)	Percentage (%) at Munshiganj (Satkhira)
Forest Department (FD)	96	36
Water Development Board (WDB)	1	2
Non-Government Organization (NGO)	2	61
Others	1	1

Most of the respondents want Forest Department for planting trees as shelterbelts in Char kukri-Mukri area but most of the respondents want

NGOs for the same work in the Munshiganj area (Table 4).

## CONCLUSION

The respondents in the study area had a generally good and favorable opinion toward shelterbelts. The respondents' rate community involvement in the coastal greenbelt project as very positive. The shelterbelt provides immediate and indirect benefits to the residents of the study region. Shelterbelt helps their socio-economic situation by increasing their income. Shelterbelt protects people from various natural disasters and has a good impact on environmental aspects. Shelterbelts encourage the growth of crops and make tourism more accessible in the area. People might be motivated to participate in the development program and manage the plantation themselves through training and awareness campaigns. People in both communities are eager to participate in embankment plantations as beneficiaries.

## REFERENCES

- Ahmad, H. (2019). Bangladesh Coastal Zone Management Status and Future. *J Coast Zone Manag*, 22:1.
- Angelsen, A., Larsen, H.O., Lund, J.F., Smith-Hall, C., & Wunder, S. (eds.) (2011). *Measuring Livelihoods and Environmental Dependence: Methods for Research and Fieldwork*. Earthscan, UK.
- Bai, J. (2010). *The role of casuarina in environmental amelioration in China*. In: Zhong C, Pinyopuarerk K, Kalinganire A, Franche C, editors. *Improving smallholder livelihoods through casuarina productivity*. Haikou: China Forestry Publishing House.
- Brandle, J.R., Hodges, I., & Wight, B. (2000). *Windbreak practices*. Madison: American Society of Agronomy, Inc.
- De Zoysa, M. (2008). Casuarina coastal forest shelterbelt in Hambantota City, Sri Lanka: Assessment of impacts. *Small-scale Forestry* 7(1):17–27.
- Dey, T., Ahmed, S., Bachar, B. K., & Kamruzzaman, M. (2020 a). Prospects of community-based ecotourism in Sundarbans: a case study at Munshiganj, Satkhira, Bangladesh. *International Journal of*

- Forestry, Ecology and Environment*, 02(01), 60-68.
- Dey, T., Kamruzzaman, M., Islam, M. A., Bachar, B. K., & Pitol, M. N. S. (2020 b). Attitudes of local people towards community based eco-tourism in the Sundarbans. *International Journal of Business, Management and Social Research*, 09(02), 528-535.
- District Statistics, Satkhira District. (2011). (Published in December, 2013) Bangladesh Bureau of Statistics (BBS), Statistics and Informatics Division (Sid) Ministry of Planning, Government of the People's Republic of Bangladesh, Parishankhan Bhaban, E-27/A, Agargaon, Dhaka-1207. www.bbs.gov.bd. p. 3.
- District Statistics, Bhola District. (2011). (Published in December, 2013) Bangladesh Bureau of Statistics (BBS), Statistics and Informatics Division (Sid) Ministry of Planning, Government of the People's Republic of Bangladesh, Parishankhan Bhaban, E-27/A, Agargaon, Dhaka-1207. www.bbs.gov.bd. p. 3.
- Fritz, H.M., & Blount, C. (2007). Role of forests and trees in protecting coastal areas against cyclones. In: Braats S, Fortuna S, Broadhead J, Leslie R, editors. *Regional Technical Workshop. Coastal protection in the aftermath of the Indian Ocean tsunamis: what role for forests and trees?* RAP Publication 2007/07. Bangkok (Thailand): Food and Agriculture Organization (FAO) of the United Nations; p. 37–64.
- Food and Agriculture Organization (FAO).(1989). Arid zone forestry: a guide for field technicians. Rome: Publication Division, Food and Agricultural Organizations of the United Nations.
- Hanjie, W., & Hao, Z. (2003). A simulation study on the ecoenvironmental effects of 3N shelterbelt in north China. *Global Planet Change*. 37(3–4):231–246
- Hipsey, M., Sivapalan, M., & Clement, T. (2004). A numerical and field investigation of surface heat fluxes from small windsheltered water bodies in semi-arid Western Australia. *Environ Fluid Mech*. 4(1):79–106.
- Hossain, M.A., Miah, M.G., & Bhowmik, S.K. (2008). Socio-Economic and Environmental Impact of Coastal Greenbelt Project of Bangladesh. *Eco-friendly Agril.J*. 1(1):53-59.
- Hossain, M. L., Hossain, M. K., & Das, S. R. (2010). *Vulnerability of Bangladesh to Natural and Anthropogenic Disasters*. Vision Publication, Dhaka, Bangladesh. pp. 219.
- Latief, H., & Hadi, S. (2007). The role of forests and trees in protecting coastal areas against tsunamis. In: Braats S, Fortuna S, Broadhead J, Leslie R, editors. *Regional Technical Workshop. Coastal protection in the aftermath of the Indian Ocean tsunamis: what role for forests and trees?* RAP Publication 2007/07. Bangkok (Thailand): Food and Agriculture Organization (FAO) of the United Nations; p. 5–35.
- McMichael, A.J. (2000). *Bull World Health Organ* 78(9): 1117-1126.
- Miah, M. D., Siddik, M. A., & Shin, M. Y. (2013). Socio-economic and environmental impacts of casuarina shelterbelt in the Chittagong coast of Bangladesh. *Forest Science and Technology*, 9(3).
- Mohammed, A., Stigter, C., & Adam, H. (1996). On shelterbelt design for combating sand invasion. *AgrEcosyst Environ*. 57(2-3):81–90.
- Nurunnahar, Pitol, M. N. S., & Sharmin, A. (2020). Status and Prospects of Agroforestry at Kaligonj Upazila in Satkhira District. *European Journal of Agriculture and Food Sciences*, 2(6).
- Rahman, S., & Rahman, M. A. (2015). Climate extremes and challenges to infrastructure development in coastal cities in Bangladesh. *Weather and Climate Extremes*, 7: 96-108.
- Ramesh, M.R., & Nijagunappa, R. (2014). Development of urban green belts – a super future for ecological balance, Gulbarga city, Karnataka. *International Letters of Natural Sciences*. ISSN: 2300-9675, Vol. 27, pp 47-53.
- Iftekhhar, M.S. (2006). Conservation and management of the Bangladesh coastal ecosystem: Overview of an integrated approach. *Natural Resources Forum*. 30(3): 230-237.
- IPCC. (2007). *IPCC Fourth Assessment Report: Climate Change 2007*. Geneva:

- Intergovernmental Panel on Climate Change (IPCC).
- Islam, A., Sharmin, A., Biswas, R., Dey, T., & Bachar, B. K. (2020). Utilization of Minor Forest Products of the Sundarbans in Bangladesh. *Adv in Agri, Horti and Ento: AAHE*-126.
- Islam, S. A., & Rahman, M. M. (2015). Coastal afforestation in Bangladesh to combat climate change induced hazards. *Journal of Science, Technology & Environment Informatics*, 02(01), 13–25.
- Islam, M. S., Abubakar, H., & Islam, M. M. (2011). Community Based Ecotourism in the Sundarbans of Bangladesh. *Rajagiri Journal of Social Development*, 3(2), 31-50.
- Islam, M. R. (2008). ICZM initiatives and practices in Bangladesh. In: Krishnamurthy, R.R. (ed). *Integrated Coastal Zone Management. Research Publishing Services*, Singapore. pp 81-82.
- Islam, M. R. (ed) (2004). *Where Land Meets the Sea: A Profile of the Coastal Zone of Bangladesh*. University Press Limited, Dhaka, Bangladesh. pp. 317.
- MoEF. (2008). *Bangladesh Climate Change Strategy and Action Plan 2008*. Ministry of Environment and Forest, Government of the People's Republic of Bangladesh. pp. xvi, 68.
- Saha, S. K., Ahmed, M. F., Roy, T. K., & Haldar, P. K. (2015). Community based ecotourism in income generation: a study on the sundarbans adjacent area of Bangladesh. *International Journal of Business, Management and Social Research*, 02(01), 80-91.
- Tanaka, N., Sasaki, Y., Mowjood, M., Jinadasa, K., & Homchuen, S. (2007). Coastal vegetation structures and their functions in tsunami protection: experience of the recent Indian Ocean tsunami. *Landscape Ecol Eng*. 3(1): 33–45.
- Thomas, M.B., Wratten, S.D., & Nick, S. (1991). Creation of island habitats densities predator arthropods: of beneficial populations and species composition. *J App Ecol*. 29(2):524–531.
- Tripp, R. (1993). *Adoption of Agricultural Technology: A Guide for Survey Design*. CIMMYT. Mexico.
- Torrey, J.G. (1976). Initiation and development of root nodules of casuarina (casuarinaceae). *Am J Bot*. 63(3):335–344.
- Wolanski, E. (2007). Synthesis of the protective functions of coastal forests and trees against natural hazards. In: Braats S, Fortuna S, Broadhead J, Leslie R, editors. *Regional Technical Workshop. Coastal protection in the aftermath of the Indian Ocean tsunamis: what role for forests and trees?* RAP Publication 2007/07. Bangkok (Thailand): Food and Agriculture Organization (FAO) of the United Nations; p. 161–184.